US006732579B2

(12) **United States Patent**
**Keith et al.**

(10) **Patent No.: US 6,732,579 B2**
(45) **Date of Patent: May 11, 2004**

(54) **TURBULENT BOUNDARY LAYER THICKNESS ESTIMATION METHOD AND APPARATUS**

(75) Inventors: **William L. Keith**, Ashaway, RI (US); **Kimberly M. Cipolla**, Portsmouth, RI (US)

(73) Assignee: **The United States of America as represented by the Secretary of the Navy**, Washington, DC (US)

( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/267,099**

(22) Filed: **Oct. 8, 2002**

(65) **Prior Publication Data**

US 2004/0065146 A1 Apr. 8, 2004

(51) **Int. Cl.**[7] ..... **G01M 9/00**
(52) **U.S. Cl.** ..... **73/147**
(58) **Field of Search** ..... 73/147

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | | |
|---|---|---|---|---|---|
| 4,879,899 | A | * | 11/1989 | Leehey | 73/147 |
| 4,896,098 | A | * | 1/1990 | Haritonidis et al. | 324/663 |
| 5,199,298 | A | * | 4/1993 | Ng et al. | 73/54.01 |
| 5,341,677 | A | * | 8/1994 | Maris | 73/147 |
| 5,511,428 | A | * | 4/1996 | Goldberg et al. | 73/777 |

* cited by examiner

*Primary Examiner*—Edward Lefkowitz
*Assistant Examiner*—Jermaine Jenkins
(74) *Attorney, Agent, or Firm*—James M. Kasischke; Michael F. Oglo; Jean-Paul A. Nasser

(57) **ABSTRACT**

A method and apparatus are presented for determining turbulent boundary layer thickness. In this method and apparatus, a pair of sensors are mounted to a solid surface interfacing with a fluid at two separate stream wise locations. A voltage output from the pair of sensors is recorded and a real non-dimensional value of a correlation coefficient is computed with measured data from the recorded voltage. A laboratory non-dimensional value of the correlation coefficient is independently determined from laboratory data. The real non-dimensional value is compared with the laboratory non-dimensional value to obtain a boundary layer thickness having a value which minimizes a difference between the values of the real non-dimensional value and the laboratory non-dimensional value.

**12 Claims, 2 Drawing Sheets**